What is claimed is:

1. A high plasma density etch process for etching an oxygen-containing layer overlying a non-oxygen containing layer on a workpiece in a plasma reactor chamber, said process comprising:

providing a chamber ceiling overlying said workpiece and comprising a semiconductor material;

supplying into said chamber a process gas comprising etchant precursor species, polymer precursor species and hydrogen;

providing a plasma source power applicator for applying a plasma source power into said chamber; and

cooling said ceiling to a temperature sufficiently low to promote polymer deposition thereon.

2. The process of Claim 1 wherein said etchant and polymer precursor species contain fluorine, and wherein said chamber ceiling semiconductor material comprises a fluorine scavenger precursor material.

3. The process of Claim 2 wherein said process gas comprises at least one of CHF_3 and CH_2F_2

4. The process of Claim 3 wherein said process gas further comprises a non-hydrogen containing etchant and polymer precursor gas.

5. The process of Claim 4 wherein said non-hydrogen containing etchant and polymer precursor gas comprises C_2F_6.

6. The process of Claim 3 wherein said process gas further comprises a species including an inert gas.

7. The process of Claim 6 wherein said species including an inert gas comprises one of HeH_2 or Ar.

8. The process of Claim 2 wherein providing said plasma source power applicator comprises providing an inductive antenna overlying said ceiling, whereby said ceiling is a window to said inductive antenna, said process further comprising:

applying RF bias power to said workpiece; and

controlling an RF potential of said ceiling.

9. The process of Claim 8 wherein controlling the RF potential of said ceiling comprises one of:

(a) holding said ceiling at an RF ground potential;

(b) applying an RF bias signal to said ceiling.

10. The process of Claim 8 further comprising:

providing a fluorine scavenger precursor material in said chamber separate from said ceiling; and

heating said fluorine scavenger precursor material to an elevated temperature above a condensation temperature of a polymer formable from said polymer precursor species of said process gas.

11. The process of Claim 10 wherein said elevated temperature is above 170 degrees C.

12. The process of Claim 10 wherein said elevated temperature is above 270 degrees C.

13. The process of Claim 10 wherein said elevated temperature is near 350 degrees C.

14. The process of Claim 10 wherein said heated fluorine scavenger precursor material comprises a semiconductor ring concentric with and adjacent said workpiece.

15. The process of Claim 10 wherein said heated fluorine scavenger precursor material comprises an interior semiconductor liner adjacent a wall of said chamber.

16. The process of Claim 1 further comprising providing a cooling apparatus over said ceiling for carrying out the cooling of said ceiling.

17. The process of Claim 16 wherein cooling said ceiling comprises:

using plural external semiconductor rings overlying and contacting said ceiling; and

using a chilled plate overlying and contacting said plural external semiconductor rings, wherein applying a plasma source power comprises using inductive elements overlying said ceiling between ones of said plural semiconductor rings.

18. The process of Claim 17 wherein said inductive elements comprise solenoidal elements.

19. The process of Claim 17 wherein said inductive elements comprise coil windings.

20. The process of Claim 1 further comprising maintaining said chamber at a pressure between about 15mT and 115 Mt.

21. The process of Claim 1 wherein applying plasma source power comprises:

providing plural respective inductive elements at respective radial locations overlying said ceiling; and

applying different plasma RF source power levels to said respective inductive elements to optimize etch uniformity across said workpiece.

22. The process of Claim 21 further comprising providing a cooling apparatus over said ceiling for carrying out the cooling of said ceiling, comprising:

providing plural external semiconductor rings overlying and contacting said ceiling; and

providing a chilled plate overlying and contacting said plural external semiconductor rings, wherein said respective inductive elements are provided so as to overlie said ceiling between adjacent ones of said plural semiconductor rings.

23. A high plasma density etch process for etching an oxygen-containing layer overlying a non-oxygen containing layer on a workpiece in a plasma reactor chamber, the process comprising:

providing a chamber ceiling overlying the workpiece and comprising a semiconductor material;

supplying into the chamber a process gas comprising etchant precursor species, polymer precursor species and hydrogen;

applying a plasma source power into the chamber; and

providing the chamber with at least two separate sources of fluorine scavenging material; and

cooling one of the at least two separate sources of fluorine scavenging material sufficiently low to promote polymer deposition thereon while heating an other of the at least two separate sources of flourine scavenging material to inhibit polymer deposition thereon.

24. The process of Claim 23 wherein providing the at least two separate sources of fluorine scavenging material comprises providing at least two of: a) a semiconductor ceiling, b) a semiconductor wall, and c) a semiconductor ring.

25. The process of Claim 24 wherein providing the reactor chamber with at least two separate sources of fluorine scavenging material comprises providing a material comprising at least one of: a) silicon or b) carbon.

26. The process of Claim 23 wherein cooling one of the at least two separate sources of fluorine scavenging material further comprises cooling the one of the at least two separate sources of fluorine scavenging material to within a temperature range sufficiently low to promote polymer deposition thereon so as to reduce polymer deposition on the workpiece.

27. The process of Claim 1 wherein providing plasma source power comprises inductively coupling source power into said chamber.

28. The process of Claim 27 wherein inductively coupling source power into said chamber comprises coupling power through said chamber ceiling.

29. The process of Claim 28 wherein providing a chamber ceiling comprises providing said ceiling comprising silicon.

30. The process of Claim 27 wherein inductively coupling source power into said chamber comprises using a coil antenna.

31. The process of Claim 30 wherein inductively coupling source power into said chamber comprises coupling power through a silicon comprising member.

32. The process of Claim 1 wherein providing a chamber ceiling comprises providing said ceiling comprising substantially semiconductor material.

33. The process of Claim 1 further comprising providing at least one of a semiconductor wall or a semiconductor ring.

34. The process of Claim 33 wherein providing a chamber ceiling comprising a semiconductor material and providing at least one of a semiconductor wall or a semiconductor ring comprises providing at least one of silicon or carbon.

35. The process of Claim 1 further comprising substantially enclosing said chamber with a silicon

comprising material.

36. The process of Claim 35 further comprising substantially enclosing said chamber with a semiconductor material comprising at least one of silicon or silicon carbide.

37. The process of Claim 1 wherein said cooling comprises cooling said ceiling to a temperature range at or below about 150 degrees.

38. The process of Claim 37 wherein said cooling comprises cooling said ceiling to a temperature range at or below about 100 degrees.

39. An etch process for etching an oxygen-containing layer overlying a non-oxygen containing layer on a workpiece in a plasma reactor chamber, said process comprising:

providing a chamber ceiling overlying said workpiece and comprising a semiconductor material;

supplying into said chamber a process gas comprising etchant precursor species, polymer precursor species and hydrogen;

providing inductively coupled plasma source pwoer into said chamber; and

maintaining a temperature of said semiconductor material within a range sufficiently low to promote polymer deposition thereon.